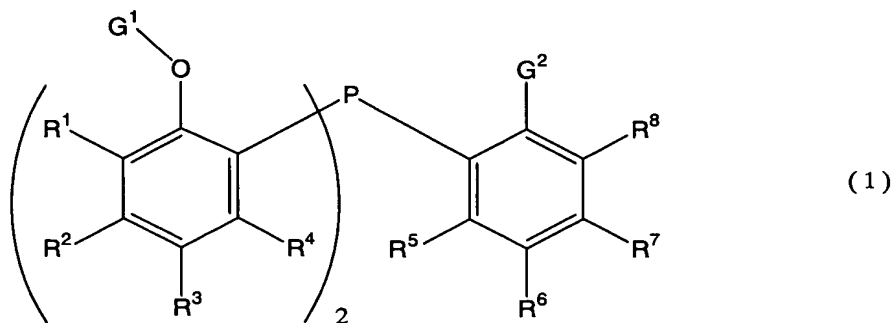


CLAIMS

1. A phosphine compound of formula (1):



wherein $R^1, R^2, R^3, R^4, R^6, R^7$ and R^8 are the same or different,
and independently represent,

a hydrogen atom,

a halogen atom,

a substituted or unsubstituted alkyl group having 1 to

10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to
20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20
carbon atoms,

a silyl group substituted with a substituted or
unsubstituted hydrocarbon having 1 to 20 carbon atom(s),

a substituted or unsubstituted alkoxy group having 1 to
10 carbon atom(s),

a substituted or unsubstituted aralkyloxy group having
7 to 20 carbon atoms,

a substituted or unsubstituted aryloxy group having 6 to
20 carbon atoms, or

an amino group disubstituted with hydrocarbons having 1
to 20 carbon atom(s);

R⁵ represents,

a hydrogen atom,

a fluorine atom,

a substituted or unsubstituted alkyl group having 1 to
5 10 carbon atom(s),

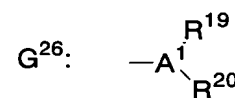
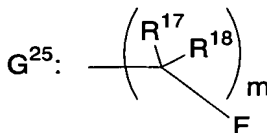
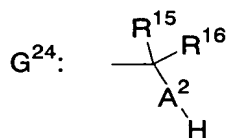
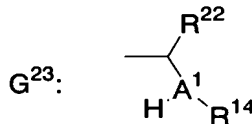
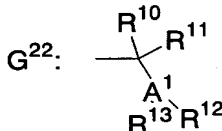
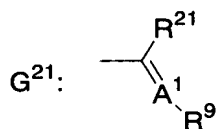
a substituted or unsubstituted aralkyl group having 7 to
20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20
carbon atoms, or

10 a silyl group substituted with a substituted or
unsubstituted hydrocarbon having 1 to 20 carbon atoms,

G¹ represents a hydrogen atom or a protective group of
hydroxyl group;

G² represents any one of G²¹ to G²⁶ below,



15 wherein A¹ represents an element of Group 15 of the periodic
table, and A² represents an element of Group 16 of the periodic
table, and A¹ in G²¹ represents a nitrogen atom;

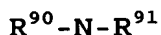
R⁹ and R¹⁴ each represents

20 a substituted or unsubstituted alkyl group having 1 to
10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to
20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms, or

a group of formula:



5 wherein R^{90} and R^{91} are the same or different, and represent

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms,

10 a substituted or unsubstituted aryl group having 6 to 20 carbon atoms, or

a cyclic structure by being linked together,

R^{12} , R^{13} , R^{19} and R^{20} each independently represents,

a substituted or unsubstituted alkyl group 1 to 10,

15 a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, or

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms; or

20 R^{12} and R^{13} , and R^{19} and R^{20} , each independently, are linked together and represent cyclic structure,

R^{10} , R^{11} , R^{15} , R^{16} , R^{21} and R^{22} each independently represents

a hydrogen atom,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

25 a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, or

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms;

R^{17} and R^{18} are the same or different, and represent,

a hydrogen atom,

a halogen atom,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

5 a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, or

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms; and

m represents an integer of 0 or 1.

10

2. The phosphine compound according to Claim 1, wherein A^1 represents a nitrogen atom and A^2 represents an oxygen group.

3. The phosphine compound according to Claim 1 or 2,
15 wherein G^1 represents a hydrogen atom.

4. The phosphine compound according to Claim 1, 2 or 3,
wherein G^2 is G^{21} .

20 5. The phosphine compound according to Claim 1, 2 or 3,
wherein G^2 is G^{22} .

6. The phosphine compound according to Claim 1, 2 or 3,
wherein G^2 is G^{23} .

25

7. The phosphine compound according to Claim 1, 2 or 3,
wherein G^2 is G^{24} .

8. The phosphine compound according to Claim 1, 2 or 3,

wherein G^2 is G^{25} .

9. The phosphine compound according to Claim 1, 2 or 3,
wherein G^2 is G^{26} .

5

10. The phosphine compound according to Claim 1 or 2,
wherein G^1 is a protective group of the hydroxyl group.

11. The phosphine compound according to Claim 10, wherein
10 G^1 is a protective group of the hydroxyl group selected from
an alkyl group having a secondary or tertiary carbon atom linked
to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted
with a substituted or unsubstituted alkoxy group.

12. The phosphine compound according to Claim 10, wherein
15 G^1 is a methoxymethyl group, an ethoxyethyl group, a
methoxyethoxymethyl group, a trimethylsilylethoxymethyl group
or a 1-ethoxyethyl group.

13. The phosphine compound according to Claim 10, wherein
20 G^2 is G^{21} .

14. The phosphine compound according to Claim 10 or a
Bronsted acid salt thereof, wherein G^2 is G^{22} .

25

15. The phosphine compound according to Claim 10 or a
Bronsted acid salt thereof, wherein G^2 is G^{23} .

16. The phosphine compound according to Claim 10, wherein

G² is G²⁴.

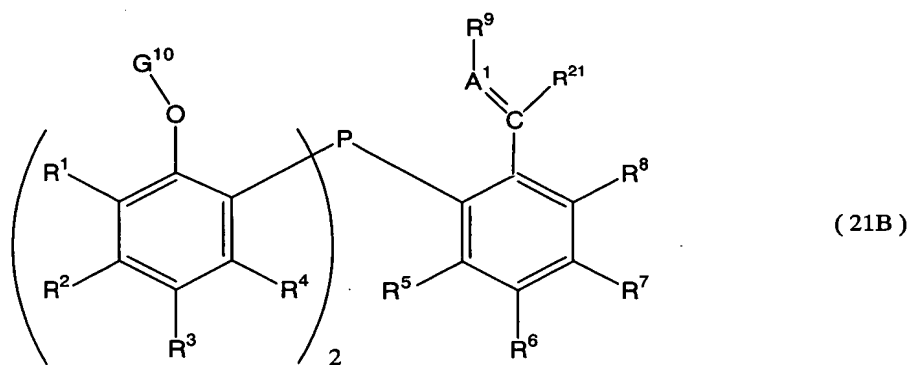
17. The phosphine compound according to Claim 10, wherein G² is G²⁵.

5

18. The phosphine compound according to Claim 10 or a Bronsted acid salt thereof, wherein G² is G²⁶.

19. The compound according to Claim 1 or 2, wherein R⁹,
10 R¹⁰, R¹¹, R¹², R¹³, R¹⁴, R¹⁵, R¹⁶, R¹⁷, R¹⁸, R¹⁹ and R²⁰ are substituted or unsubstituted alkyl groups having 1 to 10 carbon atom(s).

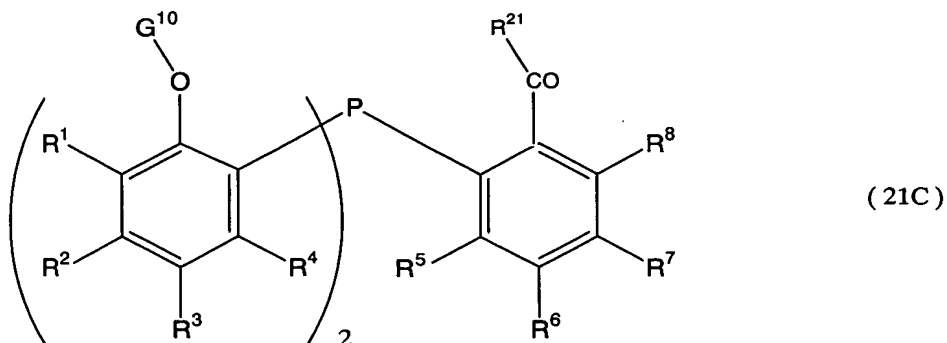
20. A production method of a phosphine compound of formula 21B:



wherein R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R²¹, G¹⁰ and A¹ are the same as described below,

which comprise reacting

a phosphine carbonyl compound of formula (21C):



wherein G^{10} represents a hydrogen atom or a protective group of the hydroxyl group selected from alkyl groups having a secondary or tertiary carbon atom linked to an oxygen atom of phenol or a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group,

R^1 , R^2 , R^3 , R^4 , R^6 and R^1 are the same or different and each independently represents

a hydrogen atom,

a halogen atom,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms,

a silyl group substituted with a substituted or unsubstituted hydrocarbon having 1 to 20 carbon atom(s),

a substituted or unsubstituted alkoxy group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyloxy group having 7 to 20 carbon atoms,

a substituted or unsubstituted aryloxy group having 6 to

20 carbon atoms, or

an amino group disubstituted with hydrocarbons having 1 to 20 carbon atom(s);

R⁵ represents,

5 a hydrogen atom,

a fluorine atom,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

10 a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms, or

a silyl group substituted with a substituted or unsubstituted hydrocarbon having 1 to 20 carbon atom(s);

15 R²¹ represents,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, or

20 a substituted or unsubstituted aryl group having 6 to 20 carbon atoms,

with an organic compound of formula (21F):

R^9NH_2 (21F)

wherein R⁹ represents

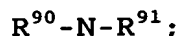
25 a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20

carbon atoms, or

a group of formula:



wherein R^{90} and R^{91} are the same or different and represent

5 a substituted or unsubstituted alkyl group having

1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having

7 to 20 carbon atoms, or

a substituted or unsubstituted aryl group having

10 6 to 20 carbon atoms, or

a cyclic structure being linked together.

21. The production method according to Claim 20, wherein

G^{10} is a protective group of the hydroxyl group selected from

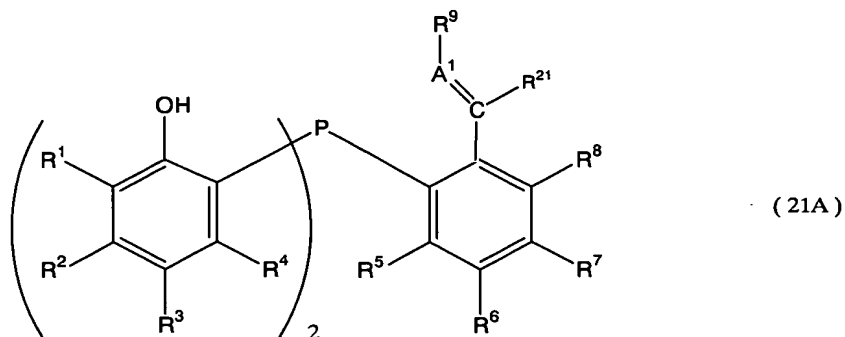
15 alkyl groups having a secondary or tertiary alkyl groups linked

to an oxygen atom of phenol, and a C1 to C2 alkyl group substituted

with a substituted or unsubstituted alkoxy group.

22. A production method of a phosphine compound of formula

20 (21A):



wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^9 and R^{21} are as defined in Claim 20,

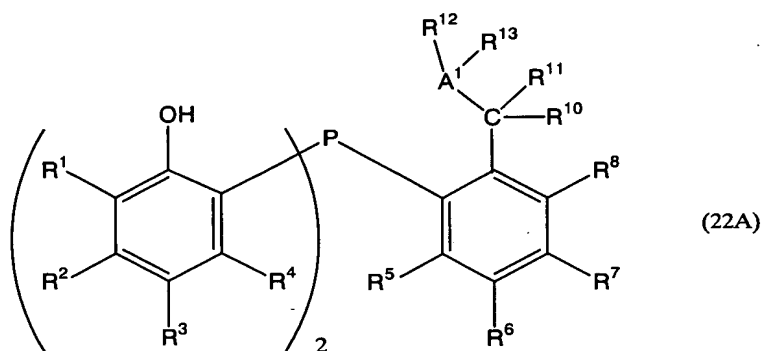
which comprises reacting the phosphine compound (21B) as

defined in Claim 20 with an acid:

23. The production method according to Claim 22, wherein the acid is hydrochloric acid.

5

24. A production method of a phosphine compound of formula (22A):

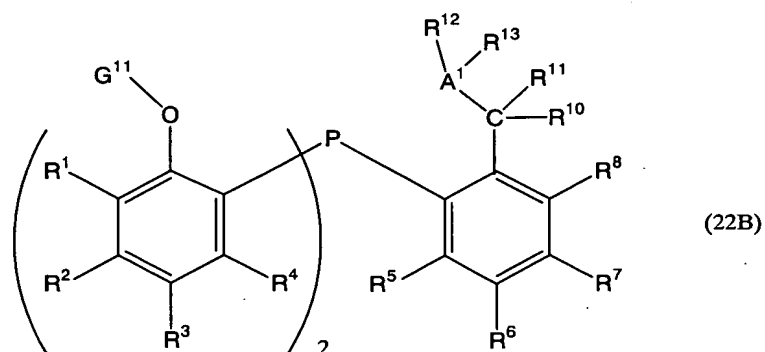


wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{10} , R^{11} , R^{12} , R^{13} ,

10 and A^1 are the same as described below,

which comprises reacting

a phosphine compound of formula (22B):



wherein A^1 , R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{10} , R^{11} , R^{12} and

15 R^{13} are as defined in Claim 1, and

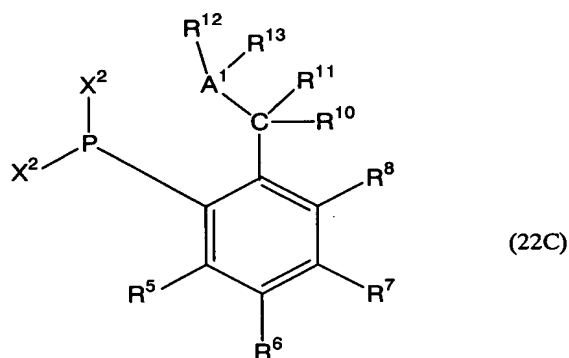
G^{11} represents a protective group of the hydroxyl group selected from alkyl groups having secondary or tertiary alkyl

groups linked to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group, with an acid.

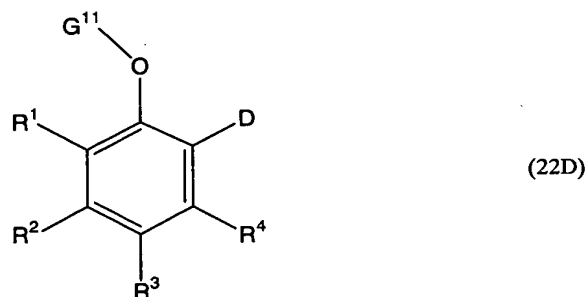
5 25. The production method according to Claim 24, wherein the acid is hydrochloric acid.

26. A production method of the phosphine compound of formula (22B) as defined in Claim 24,

10 which comprises reacting
a phosphine dihalide of formula (22C):



wherein R^5 , R^6 , R^7 , R^8 , R^{10} , R^{11} , R^{12} , R^{13} and A^1 are as defined in Claim 24, with a metal aryl compound of formula (22D):

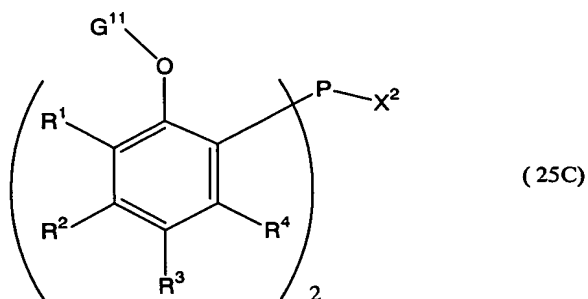


15 wherein R^1 , R^2 , R^3 , R^4 and G^{11} are as defined in Claim 24,
and

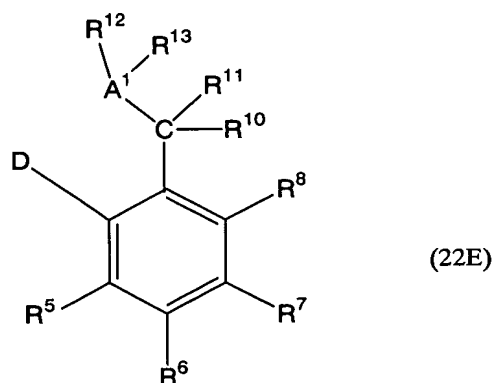
D represents an alkali metal or $J-X^3$:

wherein J represents an alkaline earth metal, and
 X^3 represents a halogen atom.

27. A production method of the compound of formula (22B)
 5 as defined in Claim 24, which comprises reacting
 a phosphine halide compound of formula (25C):



wherein R^1 , R^2 , R^3 , R^4 and G^{11} are as defined in Claim 24
 and X^2 represents a halogen atom,
 10 with a compound of formula (22E):

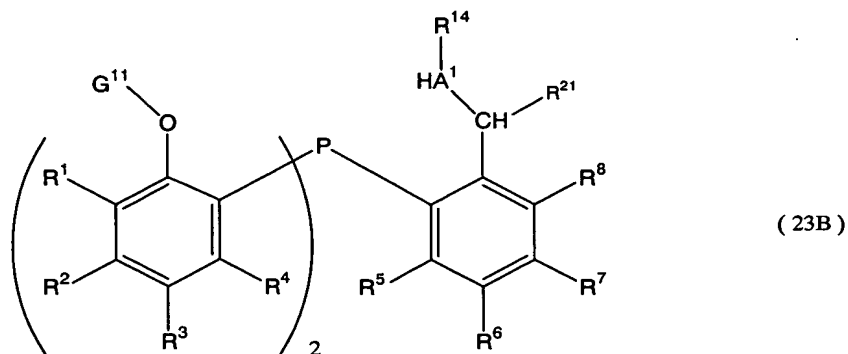


wherein R^5 , R^6 , R^7 , R^8 , R^{10} , R^{11} , R^{12} , R^{13} , A^1 and D are as
 defined in Claim 24.

15

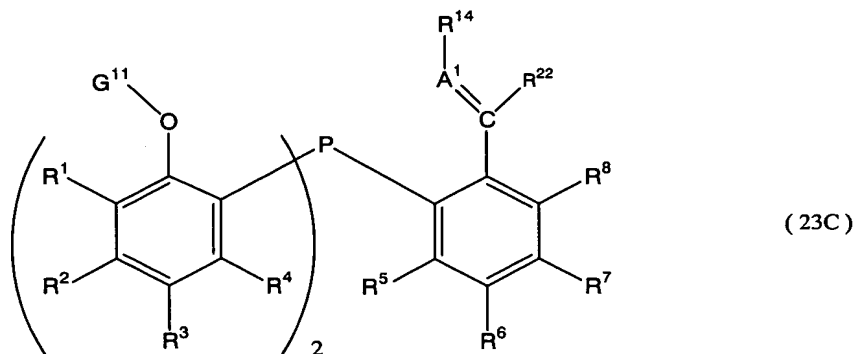
28. The compound of formula 22B according to Claim 24,
 wherein R^5 is a hydrogen atom.

29. A production method of a phosphine compound of formula (23B):



wherein R^1 , R^2 , R^2 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{14} , R^{21} , A^1 and G^{11} are as defined below,

which comprise reacting a phosphine compound of formula (23C):

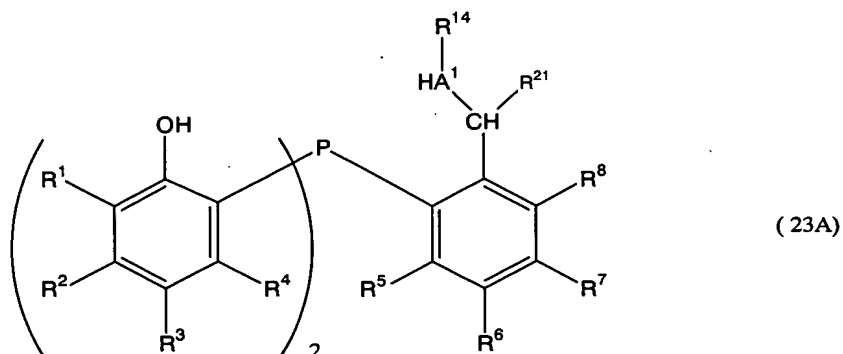


wherein A^1 , R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{14} and R^{21} are as defined in Claim 1, and G^{11} represents a protective group of the hydroxyl group selected from an alkyl group having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group,

with a metal hydride compound.

30. A production method of a phosphine compound of formula

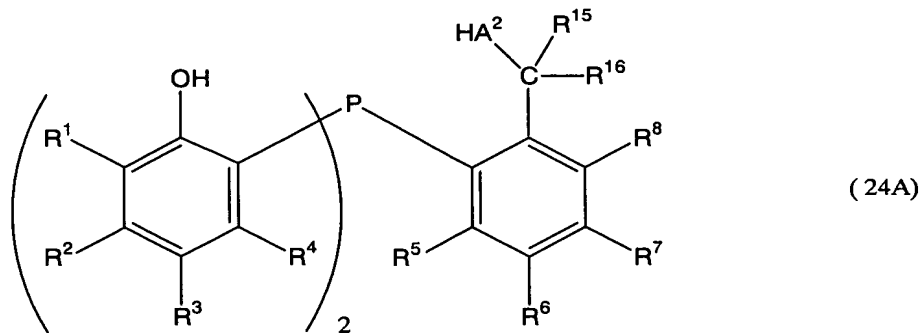
(23A):



wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{14} , A^1 and R^{21} are as defined below,

5 which comprises reacting the phosphine compound of formula (23B) as defined in Claim 29, with an acid:

31. A production method of a phosphine compound of formula (24A):

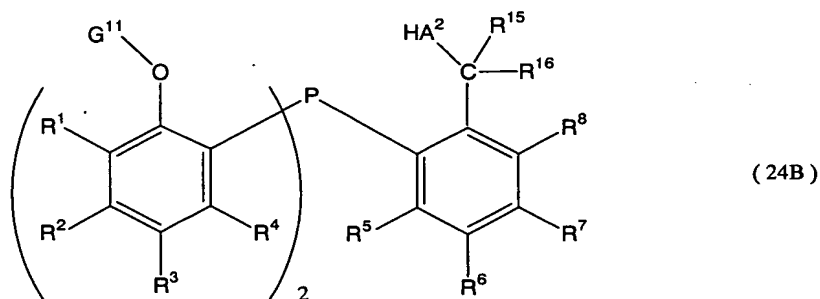


10 wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{15} , R^{16} , and A^2 are as defined in Claim 1,

which comprises reacting

the phosphine compound of formula (24B):

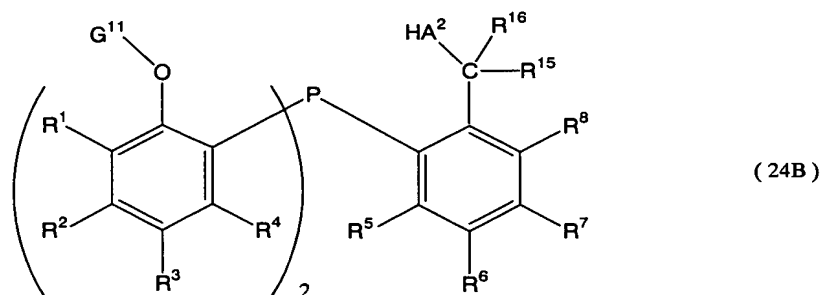
15



wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{15} , R^{16} and A^2 are the same as described above, and G^{11} represents a protective group of the hydroxyl group selected from alkyl groups having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl groups substituted with a substituted or unsubstituted alkoxy group,

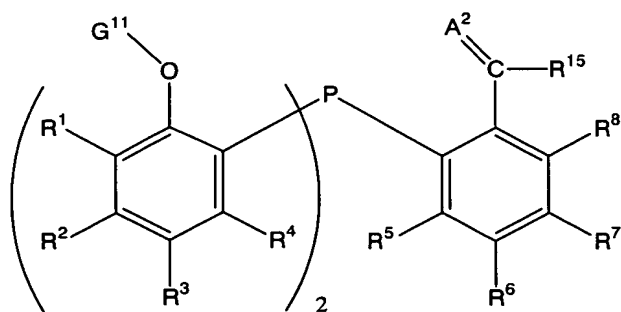
with an acid.

32. A production method of a phosphine compound of formula (24B):



wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{15} , R^{16} and A^2 are as defined below,

which comprises reacting a phosphine compound of formula (24C):



(24C)

wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 and R^{15} are as defined in Claim 1, G^{11} represents a protective group of the hydroxyl group selected from an alkyl group having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group, and A^2 represents an element of Group 16 of the periodic table,

with a metal hydride compound or a metal aryl compound of formula (24D):



wherein R^{16} is as defined in Claim 1, and

Y represents an alkali metal or $J-X^3$:

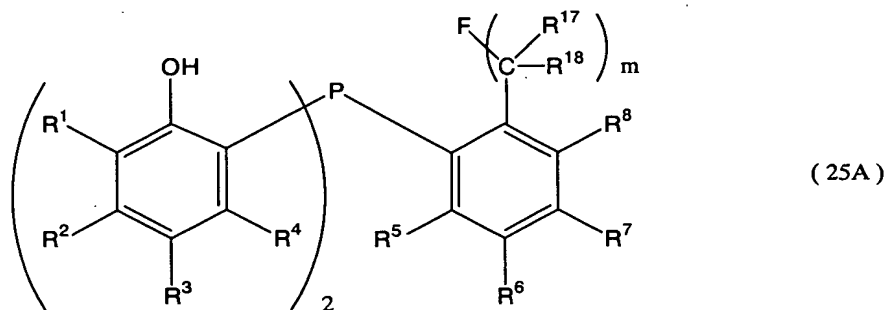
wherein J represents an alkaline earth metal, and

X^3 represents a halogen atom.

33. The production method according to Claim 32, wherein G^{11} represents a protective group of the hydroxyl group selected from alkyl groups having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl groups substituted with a substituted or unsubstituted alkoxy group, and A^2 represents an oxygen atom.

34. A production method of a phosphine compound of formula

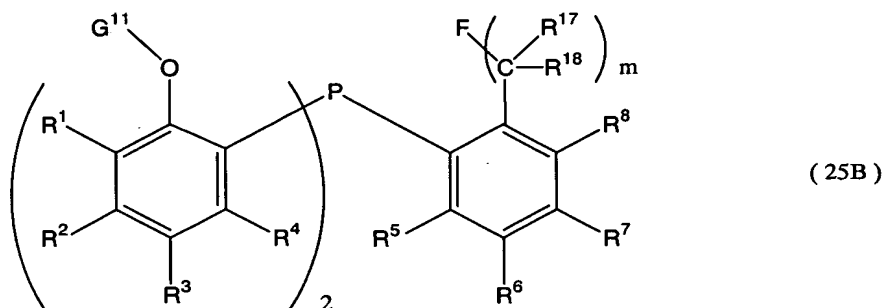
(25A):



wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{17} , R^{18} and m are as defined in Claim 1,

5 which comprises reacting

the phosphine compound of formula (25B):



wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{17} , R^{18} and m are as defined above, and G^{11} represents a protective group of the hydroxyl group selected from alkyl groups having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group,

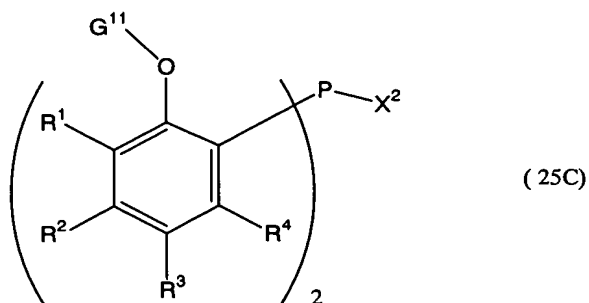
with an acid.

15

35. A production method of a phosphine compound of formula (25B) as defined in Claim 34,

which comprises reacting

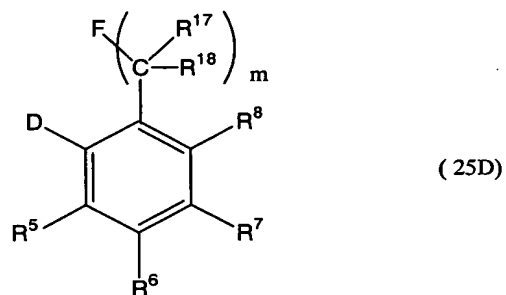
a phosphine halide compound of formula (25C):



wherein R^1 , R^2 , R^3 , R^4 and G^{11} are as defined in Claim 34,
and X^2 represents a halogen atom,

with a metal aryl compound of formula (25D):

5



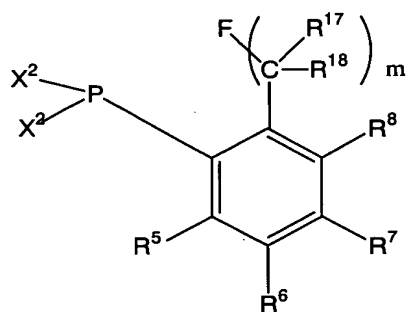
wherein R^5 , R^6 , R^7 , R^8 , R^{17} , R^{18} and m are as defined in
Claim 34, and D represents an alkali metal or $J-X^3$,

wherein J represents an alkaline earth metal, and X^3
10 represents a halogen atom.

36. A production method of the phosphine compound of
formula (25B) as defined Claim 1,

which comprises reacting

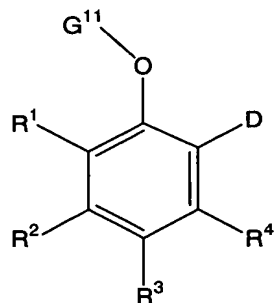
15 a halophosphine compound of formula (25E)



(25E)

wherein R^5 , R^6 , R^7 , R^8 , R^{17} , R^{18} and m are the same as those according to Claim 1, and X^2 represents a halogen atom,
with a metal aryl compound of formula (25F):

5

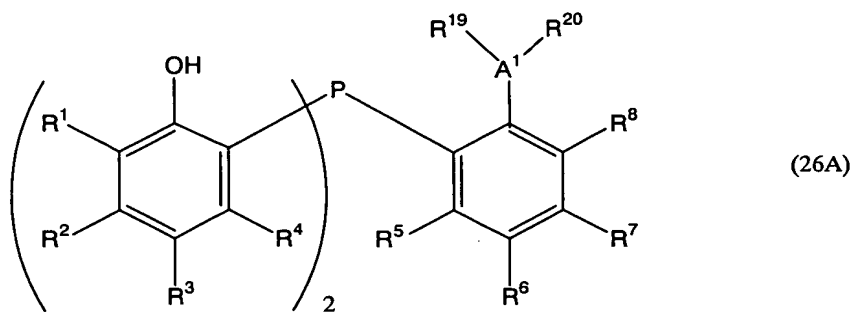


(25F)

R^1 , R^2 , R^3 and R^4 are as defined in Claim 1, and G^{11} represents a protective group of the hydroxyl group selected from an alkyl group having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group.

10

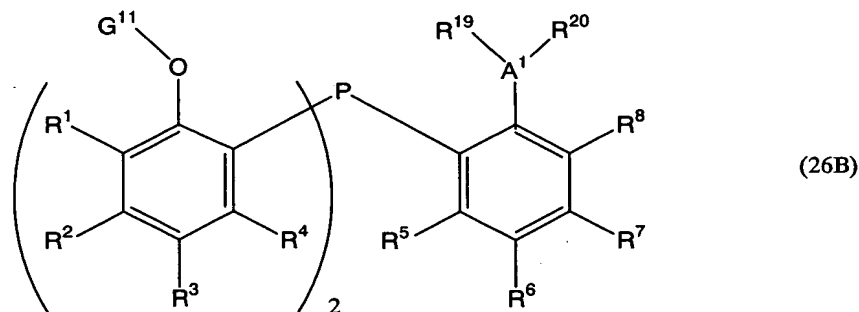
37. A production method of a phosphine compound of formula (26A):



wherein A^1 , R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{19} and R^{20} are as defined below,

which comprises reacting

5 a phosphine compound of formula (26B):



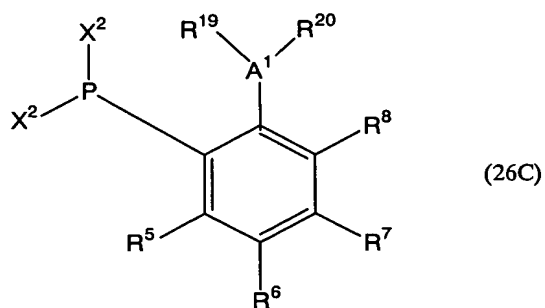
wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^{19} , R^{20} and A^1 are as defined in Claim 1, and G^{11} represents a protective group of the hydroxyl group selected from alkyl groups having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or
 10 a C1 to C2 alkyl group substituted with a substituted or unsubstituted alkoxy group,

with an acid:

15 38. A production method of the phosphine compound of formula (26B) as defined in Claim 37,

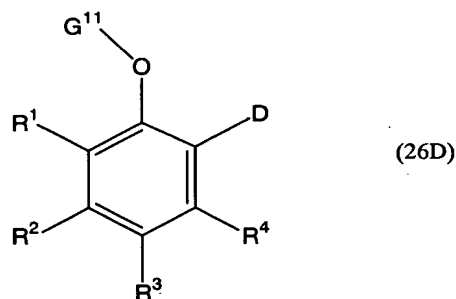
which comprises reacting

a halophosphine compound of formula (26C):



wherein R^5 , R^6 , R^7 , R^8 , R^{19} , R^{20} and A^1 are as defined in Claim 37, and X^2 represents a halogen atom,

with a metal aryl compound of formula (26D):



wherein R^1 , R^2 , R^3 , R^4 and G^{11} are the same as those described in Claim 37, and D represents an alkali metal or $J-X^3$,

wherein J represents an alkaline earth metal, and X^3 represents a halogen atom.

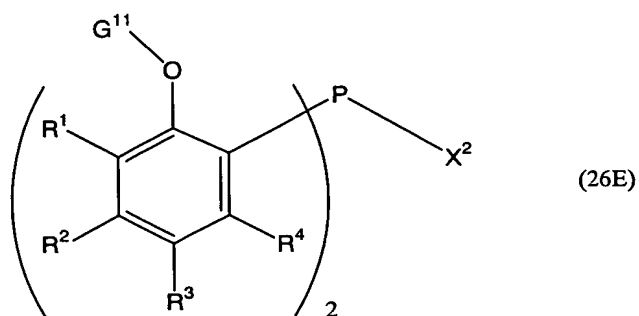
39. A production method of a phosphine compound of formula

(26B) as defined in Claim 38,

which comprises reacting

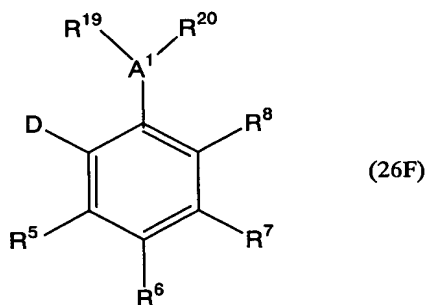
an aryl-halogenated phosphorous compound of

formula (26E):



wherein R^1 , R^2 , R^3 , R^4 and G^{11} are as defined in Claim 38,
and X^2 represents a halogen atom,

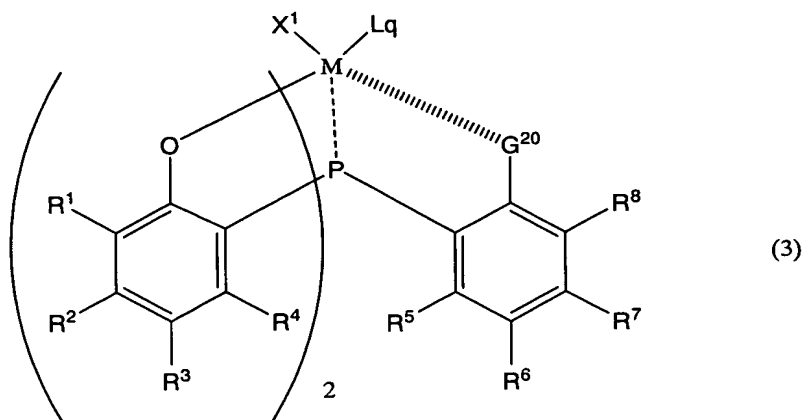
with a metal aryl compound of formula (26F):



5

wherein A^1 , R^5 , R^6 , R^7 , R^8 , R^{19} , R^{20} and D are as defined
in Claim 38.

40. A production method of a transition metal complex
10 of formula (3):



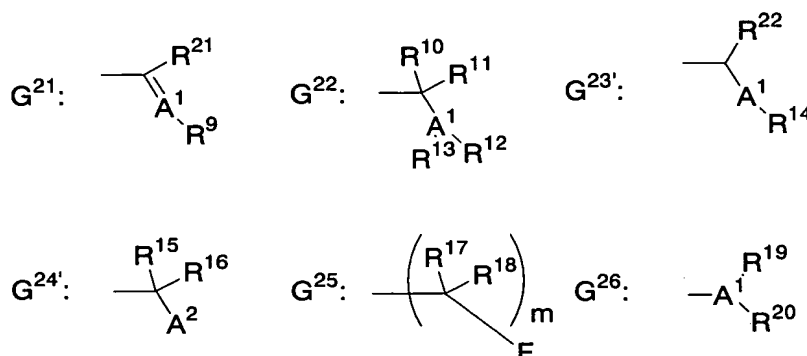
wherein M represents an element of Group 14 of the periodic

table,

$R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, X^1$ and L are as defined below,

q represents an integer of 0 or 1,

G^{20} represents any one of G^{21} to G^{26} ,



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wherein A^1 represents an element of Group 15 of the periodic table,

provided that A^1 in $G^{23'}$ represents an anion of an element of Group 15 of the periodic table and A^1 in G^{21} represents a nitrogen atom,

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A^2 represents an element of Group 16 of the periodic table,

R^9 and R^{14} each represents,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

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a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20 carbon atoms, or

$R^{90}-N-R^{91}$;

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wherein R^{90} and R^{91} are the same or different and represent

a substituted or unsubstituted alkyl group having 1 to

10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to

10 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 10 carbon atoms, or

a ring structure by being linked together;

5 R^{12} , R^{13} , R^{19} and R^{20} each independently represents

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms,

10 a substituted or unsubstituted aryl group having 6 to 20 carbon atoms, or

R^{12} and R^{13} , and R^{19} and R^{20} each independently represents a ring structure by being linked together;

R^{10} , R^{11} , R^{15} and R^{16} , R^{21} and R^{22} each independently represent

15 a hydrogen atom,

a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, or

20 a substituted or unsubstituted aryl group having 6 to 20 carbon atoms;

R^{17} and R^{18} are different one another, and represent a hydrogen atom,

a halogen atom,

25 a substituted or unsubstituted alkyl group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, or

a substituted or unsubstituted aryl group having 6 to 20

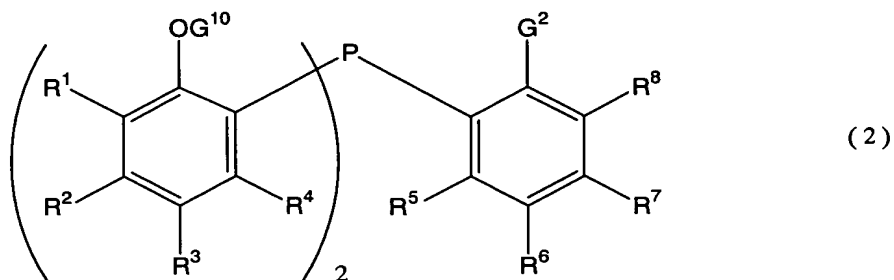
carbon atoms,

m represents an integer of 0 or 1, and

the line linking M and G²⁰ represents that M is linked
or coordinated to an element of Group 15 or 16 of the periodic
5 table or to a fluorine atom constituting G²⁰,

which comprises reacting

a phosphine compound of formula (2):



wherein R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸ and G² are as defined
10 in Claim 1, and G¹⁰ represents a protective group of the hydroxyl
group selected from alkyl groups having secondary or tertiary
carbon atom linked to an oxygen atom of phenol, or a C1 to C2
alkyl groups substituted with a substituted or unsubstituted
alkoxy group,

15 with a transition metal compound of formula (4):



wherein M represents an element of Group 4 of the periodic
table,

X¹ represents,

20 a substituted or unsubstituted alkyl group having 1 to
10 carbon atom(s),

a substituted or unsubstituted aralkyl group having 7 to
20 carbon atoms,

a substituted or unsubstituted aryl group having 6 to 20
25 carbon atoms,

a substituted or unsubstituted alkoxy group having 1 to 10 carbon atom(s),

a substituted or unsubstituted aralkoxy group having 7 to 10 carbon atoms,

5 a substituted or unsubstituted aryloxy group having 6 to 10 carbon atoms, or

an amino group disubstituted with hydrocarbons having 2 to 20 carbon atoms; and

L represents a balancing counter ion or neutral ligand, 10 being an atom or group similar to X^1 , and is bonding or coordinating to metal M,

L^1 represents a neutral ligand, and p represents an integer of 0 to 2.

15 41. The method according to Claim 40, a base is used.

42. The method according to Claim 41, wherein G^{10} is a hydrogen atom.

20 43. A production method of the transition metal compound of formula (3) according to Claim 40, wherein G^{10} is a protective group of the hydroxyl group selected from alkyl groups having secondary or tertiary carbon atom linked to an oxygen atom of phenol, or a C1 to C2 alkyl group substituted with a substituted 25 or unsubstituted alkoxy group.

44. The production method according to Claim 43, wherein G^{10} is a methoxymethyl group, an ethoxyethyl group, a methoxyethoxymethyl group, trimethylsilylethoxymethyl group or

1-ethoxyethyl group.

45. The production method according to Claim 40, 41, 42, 43 or 44, wherein M is a titanium atom or a zirconium atom.

5

46. The production method of the transition metal complex according to Claim 45, wherein A^1 represents a nitrogen atom and A^2 represented an oxygen atom.

10

47. The production method of the transition metal complex according to Claim 46, wherein G^2 is G^{21} .

48. The production method of the transition metal complex according to Claim 46, wherein G^2 is G^{22} .

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49. The production method of the transition metal complex according to Claim 46, wherein G^2 is G^{23} .

50. The production method of the transition metal complex according to Claim 46, wherein G^2 is G^{24} .

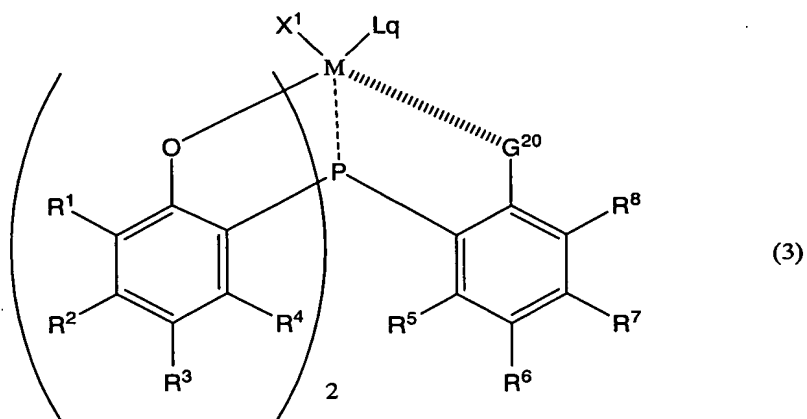
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51. The production method of the transition metal complex according to Claim 46, wherein G^2 is G^{25} .

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52. The production method of the transition metal complex according to Claim 46, wherein G^2 is G^{26} .

53. The transition metal complex of formula (3):



wherein M, L, X¹, R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, q and G²⁰ are as defined in Claim 40.

5 54. The transition metal complex according to Claim 53, wherein A¹ represent a nitrogen atom and A² represents an oxygen atom.

55. The transition metal complex according to Claim 54,
10 wherein M is a titanium atom or a zirconium atom.

56. The transition metal complex according to Claim 54 or 55, wherein G² is G²¹.

15 57. The transition metal complex according to Claim 54 or 55, wherein G² is G²².

58. The transition metal complex according to Claim 54 or 55, wherein G² is G²³.

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59. The transition metal complex according to Claim 54 or 55, wherein G² is G²⁴.

60. The transition metal complex according to Claim 54 or 55, wherein G^2 is G^{25} .

5 61. The transition metal complex according to Claim 54 or 55, wherein G^2 is G^{26} .

62. An olefin polymerization catalyst comprising a combination of transition metal complex according to
10 Claim 53, 54 or 55, compound A below, and optionally compound B:

compound A: any one of compounds A1 to A3, or a mixture of at least two of them,

compound A1: an organic aluminum compound of formula
15 $(E1)_aAl(Z)_{3-a}$,

compound A2: a cyclic aluminoxane having a structure of formula $[-Al(E2)-O-]_b$, and

compound A3: a linear aluminoxane of formula
20 $E3[-AlE3-O-]_cAlE3_2$,

wherein E1 to E3 are the same or different and each represents a hydrocarbon group having 1 to 8 carbon atom(s),

Z is the same or different, and represents a hydrogen atom or a halogen atom,

c represents 1, 2 or 3,

25 b represents an integer of 2 or more, and

c represents an integer of 1 or more;

compound B: any one of compounds B1 to B3, or a mixture of at least two of them,

compound B1: a boron compound of formula $BQ^1Q^2Q^3$,

compound B2: a boron compound of formula $Z^+(BQ^1Q^2Q^3Q^4)^-$,

and

compound B3: a boron compound of formula $(L-H)^+(BQ^1Q^2Q^3Q^4)^-$,

wherein B is a boron atom of a trivalent state, and

5 Q^1 to Q^4 are the same or different and represent a halogen
atom, a hydrocarbon group having 1 to 20 carbon atom(s), a
halogenated hydrocarbon group having 1 to 20 carbon atom(s),
a silyl group substituted with the hydrocarbon groups having
1 to 20 carbon atom(s), or an amino group disubstituted with
10 the hydrocarbon groups having 1 to 20 carbon atom(s).

63. A production method of an olefin polymer, which
comprises polymerizing an olefin in the presence of the olefin
polymerization catalyst according to Claim 62.

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